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ORIGINAL ARTICLE

Effect of Intravenous Dexamethasone in Combination with Caudal Analgesia on Post Operative Pain Control after Herniotomy in Children

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Abstracts

Background: *Dexamethasone has a powerful anti-inflammatory action and has demonstrated reduced morbidity after surgery.*

Objectives: *The aim of this study was to examine the effects of a single i.v. dose of dexamethasone in combination with caudalblock on postoperative analgesia in children.*

Methods*: This study was a randomized, double blind clinical trial, in which 77 children of ASA I and II, aged 3-10 years, undergoing elective unilateral herniotomy operation, was allocated in a double blind manner. Control Group I consist of 39 patients and Dexamethasone Group II consists of 38 patients. Group II received i.v. Dexamethasone 0.5 mg/Kg (Maximum 20 mg) and Group I received the same volume of i.v. saline after induction of anaesthesia. After inhalation induction of general anaesthesia, children received either dexamethasone 0.5-1 mg/Kg (maximum 20 mg) (n=39) or the same volume of saline (n=38) i.v. A caudal anaesthetic block was then performed using 1.5 ml/kg of Bupivacaine 0.25% in all patients. After surgery, rescue analgesic consumption, pain scores, and adverse effects were evaluated for 24 h.*

Results: *Significantly, fewer patients in the dexamethasone group required fentanyl for rescue analgesia (7.9% vs38.5%, p<0.05) in the post-anaesthetic care unit or acetaminophen (23.7% vs 64.1%) after discharge compared with the control group. The time to first administration of oral acetaminophen was significantly longer in the dexamethasone group (646 vs 430 min). Postoperative pain scores were lower in the dexamethasone group and the incidence of adverse effects was similar in both groups.*

Conclusion: *Intravenous dexamethasone 0.5-1 mg/Kg in combination with a caudal block augmented the intensity and duration of postoperative analgesia with out adverse effects in children undergoing herniotomy.*

Keywords: *Caudal anaesthesia, postoperative pain, dexamethasone, herniotomy.*

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Introduction

A caudal block is a popular reliable and safe technique for paediatric pain management after infraumbilical surgical procedures. However, in a significant proportion of patients, despite good initial analgesia from a caudal blockade with local anaesthetic, moderate or severe pain develops as the block resolves.[1-2] The addition of various drugs such as opioids, ketamine, clonidine, or dexmedetomidine to local anaesthetics has been used to improve or prolong caudal analgesia, but their use has been limited by un acceptable adverse effects in children undergoing day-case surgery.[3-7]

Dexamethasone, a corticosteroid with strong anti-inflammatory effects, provides post operative analgesia and has shown improvement in morbidity such asnausea, vomiting, fever and delayed oral intake in children.[8] Therefore, we performed this prospective randomized double-blind study to examine the effects of single intraoperative dexamethasone combined with a caudal block on recovery in children undergoing herniotomy.

Materials and Methods

Eighty ASA status I & II unpremedicated children, aged 3 to 10 yr and under-going day-case unilateral herniotomy, were enrolled in this prospective, randomized, and double-blind study. Patients were excluded from the study if they had a contraindication for caudal block including a hypersensitivity to any local anaesthetics, bleeding diathesis, infections at the puncture sites, orpre-existingneurologicaldisease. On the day of the pre-anaesthetic visit, parents were taught to perform the irrole in the study and the use ofvisual analoguepain scores (VAS, 'no pain' and 10 'the worst imaginable pain') after discharge.

The children were induced by inhalational technique with sevoflurane 8% in 100% oxygen. Standard monitoring of Non-invasive blood pressure, Electrocardiogram, Pulse oximeter were applied. After securing i.v. acecss, the children received i.v. fentanyl 1 mcgm/Kg and propofol 2mg/Kg. An appropriate sized LMA was inserted accordingly. The end tidal concentration of sevoflurane will be adjusted to deliver a minimum alveolar anaesthetic concentration (MAC) of 1. Then the children received either i.v. Dexamethasone or Normal saline according to their group allocation. After induction of anaesthesia, caudal block will be performed using a5cm short beveled 22G needle in the lateral decubitus position. After identifying the space with loss of resistance technique, the children will receive 1.5 ml/Kg bupibacaine 0.25%. Suppository paracetamol 20 mg/Kg will be given after completion of caudal block. Surgery was allowed to begain 10 minutes after performing the block. Children with an increase in heart rate of more than 20% from baseline indicating failed caudal block was given intravenous pethidine and discontinued from the study. After emergence from anaesthesia, patients were shifted to the postanesthesia care unit (PACU). Post operative pain was assessed at the end of the surgery.

Discharge criteria included clear consciousness, stability of vital signs, ability to tolerate oral fluids and void, age-appropriate level of ambulation, and absence of side-effects. Analgesia after discharge was provided with oral acetaminophen. The time to first supplemental oral acetaminophen was defined as the time from the end of surgery to the first registration of a VAS (0-10) ≥5 by parent's observation.

Results

Eighty patients were recruited to the study but three patients were excluded because of intra-operative administration of fentanyl or midazolam, so data from 77 patients were analyzed. There were no significant differences between the two groups with regard to the irage, weight, height, duration of surgery, and intra-operative fluid administration (Table I). There was no failure of caudal block in any patient.

Table I
Mean (± SD) of patient's data and intra-operative characteristics

Variables	Groups		p value[a]
	Control(n=39)	Dexamethasone (n=38)	
Age (months)	21.8 ± 6.3	20.2 ± 4.7	0.211
Weight (kg)	12.1 ± 2.7	11.9 ± 2.6	0.742
Height (cm)	84.8 ± 12.1	83.6 ± 12.4	0.669
Duration of surgery (min)	38.2 ± 11.7	38.7 ± 11.3	0.849

[a] 't' test was done to measure the level of significance
Data was expressed as Mean ± SD

The incidence of rescue fentanyl in the PACU and rescue oral acetaminophen after discharge was significantly lower in children who received dexamethasone compared with those who received saline. Eleven of the 39 in the control group and three of the 38 in the dexamethasone group receivedboth fentanylrescue in PACUand oralacetaminophenafterdischarge.Thetime to firstoral acetaminophen administration was significantly longer in the dexamethasone group compared with the control group (Table-II).

Pain scores using CHEOPS assessed at the PACU were significantly lower in the dexamethasone group than in the control group (Table III).

There were no significant differences in the incidence of adverse effects including vomiting (7.7% vs 10.5%), sedation (25.6% vs 31.6%), and shivering (2.6% vs 0%), all adverse effects were also well controlled by a single dose of antiemetic and meperidine. The majority of patients (79.5% of the control group and 97.4% of the dexamethasone group) were satisfied (excellent or good) with the postoperative pain management. Patients in the dexamethasone group were more satisfied than those in the control group (Table IV).

Table II
Distribution of postoperative rescue analgesics

Variables	Groups		p value
	Control(n=39)	Dexamethasone (n=38)	
Rescue fentanyl at PACU	15 (38.5)	3 (7.9)	0.002[b]
Rescue acetaminophen after discharge	25 (64.1)	9 (23.7)	<0.001[b]
Rescue fentanyl+oral acetaminophen	11 (28.2)	3 (7.9)	0.021[b]
Time of first acetaminophen (min)	430 ± 135	646 ± 107	<0.001[a]

[a] 't' test was done to measure the level of significance. [b] Chi square test was done to measure the level of significance Data was expressed as Frequency (Percent) or Mean ± SD

Table III
Post-operative pain score

Variables	Groups		p value
	Control(n=39)	Dexamethasone (n=38)	
No pain	8	2	0.002[b]
Wirst immaginable pain	31	36	

[b]Chi square test was done to measure the level of significance

Table IV
Distribution of postoperative variables

Variables	Groups		p value
	Control(n=39)	Dexamethasone (n=38)	
Required fentanyl for rescue analgesia	15 (38.5)	3 (7.9)	0.002[b]
Acetaminophen after discharge	25 (64.1)	9 (23.7)	<0.001[b]
Incidence of adverse effects			
Vomiting	4 (10.3)	3 (7.9)	0.999[c]
Sedation	12 (30.8)	10 (26.3)	0.665[b]
Shivering	0 (.0)	1 (2.6)	0.494[c]
Satisfaction			
Satisfied	31 (79.5)	37 (97.4)	0.029[c]
Not satisfied	8 (20.5)	1 (2.6)	

[b]Chi square test was done to measure the level of significance. [c] Fisher's Exact test was done to measure the level of significance. Data was expressed as Frequency (Percent) or Mean ± SD

Discussion

A single dose of i.v. dexamethasone (0.5-1 mg/Kg) in combination with a caudal block reduces post operative pain, decreases rescue analgesic requirements, and prolongs analgesic duration compared with a caudal block alone.

In the present study, we demonstrated a single dose of i.v. dexamethasone decreased the need for analgesia after discharge by 63% and increased the duration of analgesia by upto 50% compared with patients who received a caudal block alone. Furthermore, it must be stressed that i.v. dexamethasone was not associated with adverse effects in our study. Steriod have a powerful antiflammatory action and have a demonstrated reduced pain and swelling after oral surgery, spinal surgery, and laparoscopic surgery.

However, the exact mechanism by which dexamethasone may exert an analgesic effect is not fully understood. Systemic administration of steroids has been found to suppress tissue levels of bradykin in[9] and the release of neuropeptides from nerve endings,[10] both of which can enhance nociception in inflamed tissue. The established reduction in prostaglandin production might further contribute to analgesia by inhibiting the synthesis of the cyclooxygenase isoform-2 in peripheral tissues and in the central nervous system.[11] They also inhibit other mediators of inflammatory hyperalgesia, for example, tumour necrosis factor-a, interleukin-17b,and interleukin-6. Thus, despite the fact that the mechanism is not yet fully understood, a reduction in pain by steroids has been supported by many studies. The plasma elimination half-life is only about 6 h, and so there seems to be ongoing drug effects for a significant period of time after drug clearance from the plasma.

Many investigators have studied the effects of systemic steroids in reducing postoperative pain and morbidity; but, there is no consensus regarding the irroutineuse, particularly inchildren. Results have been conflicting; some studies demonstrating benefit and othersnot.[12-13] In addition, most published studies for children have been limited to the otolaryngology procedures with wide ranges of dexamethasone (0.4-1.0 mg/Kg) with maximum doses from 8 to 50 mg). Many studies have included children who exceeded the weight in kilograms over the maximum dose allowed; that is, there was no weight normalization of the treatment group. Differences in the dose of dexamethasone, surgical and anaesthetic techniques, intraoperative opioid use, and lack of standardization for pain scoring and management may explain in part the conflicting results reported in prior studies. Therefore, we chose a single dose of 0.5 mg/Kg dexamethasone for children (maximum dose of 20 mg).

One of the major end points of this study, the first oral acetaminophentime, represents the parent's subjective impression of the child's pain. Because oral acetaminophen was administered after discharge, parents were frequently the sole assessor of their child's analgesic requirements. Although parental assessment of pain may be subject to bias, it has not been well studied, and we used observer VAS measures of pain to determine the need for rescue analgesic after discharge. A number of studies have provided varying levels of support for the validity of CHEOPS for the assessment of pain in post operative children. However, as a consequence of the tight observational and recording inter-vals, and the numerous types of behaviour, evaluating pain is burden some for the parent. Further more, Beyer et al[14] found that CHEOPS scores were generally very low after discharge and that over time, self-reports of pain worsened. Thus, CHEOPS may be valid only during the immediate postoperative period. Tarbell et al[15] also noted that the strong correlation between CHEOPS and observer VAS measures of pain may mean that it is more practical to use observer VAS.

Dexamethasone may exert an antiemetic action via prostaglandin antagonism, serotonin inhibition in the gutandrelease of endorphins. In this study, we found no difference and the incidences of vomiting were very low in both groups. This may be related to the lack of administration of intraoperative opioids and combined pain management with caudal analgesia.

The risk to patients of a single dose of dexamethasone appears to be minimal. We did not measure the plasma concentrations of dexamethasone, cortisol or any other par- ammeters associated with i.v. dexamethasone because invasive blood samplings for hormonal assay sand long-term follow-ups were not applicable especially in children under-going day-case minor infraumbilical surgeries.

Conclusion

Intravenous Dexamethasone 0.5 mg/Kg after induction of anaesthesia provided better postoperative analgesia than placebo after herniotomy in children.

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